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AN

ESSAY

TOWARDS A

METHOD

OF PRESERVING the

SEEDS of PLANTS

In a State fit for VEGETATION, during
Long VOYAGES.

For the IMPROVEMENT of the

BRITISH COLONIES in AMERICA,

By the Rev. Mr. PULLEIN.

LONDON:

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T O T H E
R I G H T H O N O U R A B L E
The Earl of B U T E.

My Lord,

I Am encouraged by former favours, and by your Lordship's knowledge of Vegetable Nature, to put the following essay under your Lordship's protection. If it shall be found to contain any thing which may be of publick service, your Lordship's reputation cannot fail of advancing this intention of

Your Lordship's

very obliged, and

humble Servant,

SAMUEL PULLEIN.

October 27,
1759.

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A N
E S S A Y

On PRESERVING the

SEEDS of PLANTS, &c.

IT has been the opinion of most Botanical writers, that the seeds of Plants could not be preserv'd in a State fit for vegetation, if the admission of fresh air was totally hindered: and on this principle, they have advis'd that seeds should not be cork'd up in bottles, or in any other way closely confin'd; and to strengthen this opinion, they have mention'd, if I remember right, the bad success which they have had in raising seeds which were kept in this manner.

I will not dispute this fact; but yet I am of opinion, that the reason why such seeds did not vegetate, was not because fresh air was excluded, but because they were confin'd in an air, which, by being pent up and loaded with the matter perspiring from the seeds, became continually more unwholesome, so as at last to destroy the vegetative principle.

But, whatever were the cause, that seeds thus kept did not grow, I will venture to propose an opinion very different from that which had been generally receiv'd, by all whom I ever talk'd to, or read on this subject: and this is, that the most like-

ly method to preserve the vegetative principle of seeds, for any long space of time, is totally to exclude the air; and on this principle I shall offer such methods, as I judge will be found most effectual and most practicable. I shall indeed only offer them as essays for tryals, because tho' I have long since made some experiments which strengthen my opinion, and tho' the theory on which I founded them seems to me very reasonable, yet, as judicious experiments must always establish or overthrow a theory, so must many and repeated tryals be always of greater weight than a few.

It is about seven or eight years ago that I intended raising some Mulberry trees from some seed which I had collected, and not having at that time a convenience of ground, I was desirous of preserving the seed to a convenient time, because in the situation I then was, I could not easily procure more.

The following considerations then occurred to me first, that seeds wasted and lost their vegetative strength by continual perspiration, which lessened that nutritious part on which the young germ was to be nourished; secondly, that the external air, besides being a great promoter of this perspiration, acted also as an instrument of vegetation, and by frequently putting this principle in motion, and not being aided by sufficient moisture to compleat its work, did often totally destroy the vegetable life of the germ. The many curious experiments which Romeur had made on the preserving of eggs in a state fit for incubation, and the observations which have been made on those eggs where the punctum saliens had been put in motion, and afterwards stopped by cold, did at the same time occur, and (by trans-

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ferring the analogy from animals strengthen my opinion. The consideration also of seeds, which were suppos'd to lie many years in an unvegetating state at great depth in the earth, had some weight, tho' this might indeed possibly be from want of heat and moisture as well as of air.

Upon this conjectural theory I then made the following experiment: I collected a considerable quantity of ripe Mulberries, and putting them into a coarse cloth, pressed out as much of the juice as I could, so that the pulp with the seeds in it remained in the consistence of a paste; I took this and formed it into the shape of a round flat cake about three quarters of an inch thick, and six inches diameter, smoothing it so with my hand that there was no crack nor roughness in it; I then laid it upon a piece of paper, and placing it upon a board put it in the sun to dry, now and then turning its under side uppermost. When it was grown of sufficient hardness to stand on its edge, I brought it into the house, and placing it on a shelf, in that situation, I suffered it to attain its utmost dryness and hardness in the shade, after which I wrapped it slightly in some paper and laid it up. While I was drying it I was forced to secure it from mice, which are very greedy of the sweet kernel which the seed contains, and once or twice eat a good deal of it.

On the ensuing spring I sowed a small quantity of the seed, softening a piece of the cake in water, and then mixing it with sand to divide and separate the seed. This in about six weeks sprung and produced plants. The remaining part of the cake I smeared over with a feather dipped in melted tallow, so as to leave no part uncovered, and laid it
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up for further tryals : I sowed some of this after four years, and it sprung and produced good plants ; and I have yet some of it which is above seven years old, which I make no doubt will grow, because upon examining the small kernels contain'd in the seed they were plump and fair.

The reasons why I did not smear the cake with tallow as soon as it was dry, was because I judged it necessary that the seed should be free from all superfluous moisture, and the kernel attain a certain degree of firmness, before its perspiration was totally stopped by the tallow ; and I knew that it retained its vegetative power when I stopped it. Indeed I have tried and found, that the seed will grow after two years (beyond which I have not tryed it) by barely preserving it in such a cake as I have described, without smearing it with tallow ; for the pulp of the berry does a good deal stop perspiration, and hinder the kernel from wasting itself.

From the time of making the above mentioned tryals, I thought no further on this subject till about a year ago, at which time, there being a design of introducing some of the East-India plants into America, I was asked my opinion concerning some effectual method of preserving them, and I then gave the above thoughts and experiments as pointing a very probable means of success : but that further trials may be made by those who have better opportunities than I, I shall here give what occurs to me as necessary or useful in this method of preserving seed ; which, tho' it should reflect only a faint light, may possibly help to discover something useful in this enquiry.



T H E
P R E F A C E.

HAD I met with that candour which always attends true philosophy, or that decency of behaviour which attends true breeding, then neither the following Essay should ever have appeared under my name, nor should this preface, now added after publication, have asserted my right to it. It should have been ceded to the captor, tho' not as lawful prize, yet at least as such which I did not think worth a quarrel. But as Mr. E——s, by assuming the liberty to treat me in a very insulting and magisterial manner, first forced me to wrest my invaded property out of his hands, and to let him see that I was not that tame animal to bear such an aukward, unskilful rider; so has he now, by his repeated private insinuations of my having stolen the hint from him, forced me to redress such injurious treatment, by remedies drawn from the rust of the weapon that gave the wound. The following, therefore, are facts which I deliver upon the veracity of a man and the faith of a Christian, so far as I can rely upon my memory.

Toward the latter end of summer fifty-eight, being in company with Mr. E——s, he seemed very desirous of knowing some method to preserve the seeds of plants, and talked of keeping them cold by putting them in clay or sand: his philosophy was not at that time even able to in-

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form him that substances void of motion acquire the warmth of the contiguous air, nor did he so much as dream of totally excluding the action of the air, and preventing perspiration; but, according to the prevailing opinion, he thought air in some sort necessary. After throwing out some vague opinions and conjectures of the above kind, he asked me what method I would propose in order to keep seeds cold. I told him I should use a different method of preserving them; and that it could be done by inclosing them in tallow or any resinous gum, so as totally to exclude the air and stop their perspiration; that Romeur's manner of preserving eggs was a good analogous reason for this method; and that I had, five or six years before, tried it upon some mulberry seed, which grew after four years keeping: I mentioned that there was some trouble to clear the seed of the matter in which it was preserved, which was necessary to be done before it was sown. And I remember he then said that Gum Arabic might be used, which would easily wash off; but, for reasons which I have given in the following essay, I did not think any materials proper but such as were of a fatty or resinous nature.

After this I found him at various times busied in the inclosing of acorns in clay, in Gum Arabic, and in beeswax; often saying, "that if he could find out a method of thus preserving seeds, it would be the greatest invention the age had produced;" but never dropping the least expression that I had pointed it to him: nay, so far did he carry the avoiding any distant hint of that kind, that one day when one of his acquaintance was in the room, and I happened to say, "You remember when I first mentioned this method;" he turned short from me and said, "I remember nothing." Such disingenuous behaviour did indeed raise my contempt; yet, rather than have any wrangling with one of his cast, I should have let him enjoy his spurious credit, had he not prevented it by a subsequent provocation of a very unfriendly and insulting nature. It was as follows.

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I had made several experiments, which shewed the goodness and the large quantity of silk in a particular species of cocoon which was a native of America; and found that it was the same as that from which the Chinese make a particular kind of silk, but that the people of America had not attended to it. I one day mentioned this to Mr. E——s, and that I intended giving a short account of it to the R. Society, that the people of America might be apprised of its value. He flouted at this proposal, and said it would first be proper for him to produce some of the cocoons before the Society, and to give the natural history of the animal; but as I did not see the necessity of any such parade, but plainly saw that he intended I should appear only as an operator under his direction, I inclosed the experiments I had made in a letter to the secretary of the Society, and they were read at next meeting, but I was not present. A few days after, I met Mr. E——s at the Premium Society, and upon asking him how he did, he frowning turned from me with this polite answer, for I will mention his very words, “You are a pretty chap, to give in a paper to the Royal Society without consulting me.” My utter contempt of such insolent assurance made me calm enough to try how far he would carry this humour. I saw him two or three times after; he persisted in the same disposition, said “he could tell me that my paper was ill received by the Society,” and shewed a resentment so childishly forward, and at the same time so magisterial, that it would appear almost trifling to mention it. Yet that paper which he said was so ill received, and which, by his account, I thought the R. Society had rejected, was ordered to be printed among the transactions of this year.

A treatment so disingenuous and overbearing, determined me to let Mr. E——s a little know his own unimportance with me. I wrote to him that I intended publishing my method of preserving seeds, and gave him some cautions which prudence should have listened to; but he had gone too far to recede, and having often mentioned this method as his own invention, was now under a necessity of insinuating that I took the hint from him: but if I
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had been capable of giving such an affront, as the placing a spurious production under that protection to which I have addressed it, or were my mind so insensible of its own reproach, as to steal, and plume itself upon the invention of any man, Mr. E——s's spring would have been the last I should have applied to, as having a source so scanty, that a single drop of water must have been missed. Had I intended to shine in botanick heraldry, Mr. E——s could indeed have furnished me with catalogues of the marriages, concubinage, and kindred of plants; but the science of a king-at-arms would furnish but poor materials towards an essay on the nature of man; and as to Mr. E——s's sagacity for discovering truth or detecting error, I could shew a notable instance of it relative to the present subject, did I not think that, though I have retrenched as much as I could, I have already said more than is of any concern to the * Publick; yet before I quit I must inform Mr. E——s that he owes to the intreaty of a very humane gentleman, whom he may readily guess, that I did not animadvert on him some months ago, and he owes to his own unabashed obstinacy that I do it now. If he thinks proper publicly to maintain his assertions, I shall take proper notice of it, but I shall not think myself further obliged to search out his private insinuations, or pry after the filmy traces of secret obloquy.

* I am obliged to the gentlemen for their compliments and favourable opinion given in their Critical Review of March. But I am afraid the method which they offer, as a query, of keeping seeds in a vessel exhausted of air would not be successful; because I am suspicious of the bad effect which might be produced by exhausting the air contained in the seed; and I also imagine, that the taking off the pressure of the atmosphere would cause the air contained in the germ to burst and destroy its tender vascular texture. The chief advantage which I propose by coating the seeds, is to stop their waste by perspiration, and to hinder the action of the external air, as an agent both in perspiration and vegetation, which I deduced from the analogy between seeds and eggs. It may also have another good effect, as the ingenious Mr. Read lately reminded me, of preserving the seed from insects; especially if some bitter or other proper ingredients are mixed in the composition.

First then, it appears to me to be necessary that the matter used to preserve seed should be of the nature either of tallow, rosin, or bees wax ; for tho' it may be thought that mucilaginous gums might serve, yet it is to be considered that they both admit moisture and throw it off into the air, and therefore if we suppose (for instance) a hazel nut coated with such gum, then as fast as the juices of the kernel pervade the shell, they will be imbibed by the gum, and being further drawn to its surface will be taken up by the air, so that such kind of gum will have little efficacy in preserving the nutritious juice of seeds from wasting for any long time ; whereas if we suppose the same nut coated with tallow, wax or rosin, then as fast as the juice pervades the shell, it will be arrested by the tallow, &c. which it cannot pervade, and according to the heat or cold, and the perspiring or imbibing state of the kernel, it will be thrown on the resin, or re-sorb'd from it by the nut.

It seems in the next place necessary, that the preserving matter should have a certain degree of consistence, so as not to be melted by the greatest heat of the weather ; and yet it should melt with such a degree of heat as shall not injure the seed while it is used in coating it.

From some experiments which I have made, using Farenheit's thermometer, I find the following substances melt, and continue fluid nearly at the degrees here set down ; I say nearly, because it is no easy matter to fix the precise point in bodies that have a tenacious fluidity.

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Butter melted about, deg. 86, continued fluid to 75:
 Tallow melted at———110, continued fluid to 97.
 Bees-wax melted at———148, continued fluid to 142.
 * Sulphur melted at———222, continued fluid to 214.

Resin is very undetermined in the degree that melts it to fluidity, which fluidity it immediately loses and becomes tenacious. That kind which I tried grew fluid at 180.

From an inspection of these heats it appears, that butter melting with too low a degree of heat, is capable of being dissolved by the weather, and therefore an improper material: and that resin and sulphur losing their fluidity at high degrees are too hot, and would endanger the seeds; but tallow or bees-wax, on account of the more moderate heat in which they continue fluid, and because they require a degree greater than the ordinary warmth of air in any climate to melt them, may be proper materials to coat seeds, in order to hinder perspiration, and to exclude the action of the air.

Now as different seeds, according to their size, form, &c. will require a different method of coating, I shall here by way of specimen apply a method to the hazel-nut, which, with some small occasional variations, may serve for the larger kinds of seed.

* Sulphur has a peculiar quality which I don't know that any chymical writer has mention'd, viz. with a degree of heat about 222, it is as tenacious as thick melted glue, but with a less degree about 214, just before it is become solid, it is as fluid as water.

Tallow mix'd in different proportions with any of the more fluid and least tenacious oils, will constitute mixtures, which will still keep fluid, with lower degrees of heat even down to 43, the degree at which oil olive loses its fluidity. I mention this not as properly pertinent to the present subject, (where a degree of heat, much below that of melted tallow, cannot conveniently be used in the hotter climates) but because I think, on this principle, there may be constructed very convenient and cheap thermometers for common use in hot-houses, which shall only consist of small glass vials, containing different proportions of tallow, and such oil as I have mentioned; for when the degrees of heat, at which the different mixtures continue solid or fluid, transparent or opaque, are fix'd by experiment, then each vial may be made a distinct thermometer, which will regulate the degree of heat that is known to be most agreeable to different plants in every different part of the hot-house. But to return to the subject of this essay, tho' plants may have their vegetative principle preserved in the manner which I have described, yet there is one thing still to be observ'd, and this is, that in any case where the seed itself is smear'd with tallow or wax, it is necessary before it is sown to clear it away; for Romeur observes, that eggs which were varnished over, would not produce chickens, unless the varnish was scraped off, nor even then, till new pores were opened by such scraping, to supply the place of those which had been filled by the varnish; and, by a parity of reason, it seems necessary, to free the seeds of plants from every thing that might stop their pores: and to do this, no more is necessary than to scrape the larger
seed

feed with a knife, and the smaller kind may be rubbed in a bag with soap-water and a little fine sand in such a degree as their texture will bear, till the wax or tallow is cleared away, and free access given to air and moisture, which, with the addition of heat, are the great instruments of vegetation: and here there occurs to my memory, a method proposed lately by Linnæus, for preserving feeds in a vegetating state, by keeping them very cool by the means of some particular kinds of salt. Could he indeed have kept them cool by this method, the thing had been effected, but he seemed to me to proceed intirely upon theory, without experience; for salts do not produce cold but in the act of solution; and I have not found, that any dry salt, which has stood so long in the air as to acquire its temperature of heat, will in the least degree sink the thermometer which stands in the same air. This made me suspect Linnæus's method when it was first mentioned; and what I have since try'd on salts, strengthens my suspicion. And here let me mention, that though artificial fires will indeed heat air in the coldest climates; yet, to cool sufficient quantities of air for respiration in hot climates, there seems but one method probable, which is to make the air descend slopingly in pipes or channels, cut thro' the bodies of hills, and thus convey it into houses situated on the sides, or at the foot of such hills. Air by such a passage, might acquire a more temperate degree; and as it became cooler, would, I believe, sufficiently descend by its own weight, or might at least be drawn through in sufficient quantities by a ventilator; a thing, which, could it be easily perform'd, would be a most comfortable circumstance in many of our hotter colonies of America.

If what I have delivered on the subject with which I set out, should answer my expectation, and produce an easy and effectual method of preserving seed in a vegetative state for a length of time, sufficient to transport them from the East-Indies, to any part of America, then, as we have possessions there, which take in all the different climates of the East, it is very probable, that many of its productions may be rais'd in our own colonies or islands; such as teas, spices, and many other valuable commodities; nor do I suppose, that those skilled in these matters, will think that the raising such commodities in the colonies would hurt the revenues of the crown, but rather be an advantage, as duties might be rais'd higher in proportion, as the distance, and consequently the expence of importation, lessened.

Such a happy event as this, would open an easy commerce between Great-Britain and America, in commodities which are now procured at the expence of long voyages and dangers. The bretheren of each country would then reap the advantages of their situation, and a Minister, whose councils have so well defended the property of the western world in a glorious war, would feel the pleasing sensation of having secured, and therefore promoted, the ARTS of PEACE.

F I N I S.

